

1998 AP Calculus AB Free-Response Questions

CALCULUS AB

Section II

Time—1 hour and 30 minutes

Number of problems—6

Percent of total grade—50

A GRAPHING CALCULATOR IS REQUIRED FOR SOME PROBLEMS OR PARTS OF PROBLEMS ON THIS SECTION OF THE EXAMINATION.

REMEMBER TO SHOW YOUR SETUPS AS DESCRIBED IN THE GENERAL INSTRUCTIONS.

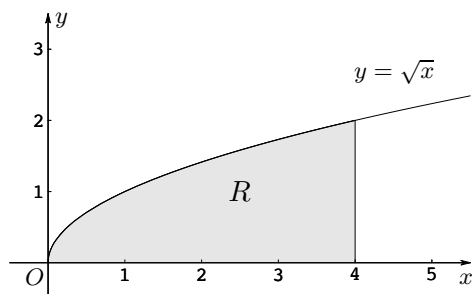
-
1. Let R be the region bounded by the x -axis, the graph of $y = \sqrt{x}$, and the line $x = 4$.
- (a) Find the area of the region R .
 - (b) Find the value of h such that the vertical line $x = h$ divides the region R into two regions of equal area.
 - (c) Find the volume of the solid generated when R is revolved about the x -axis.
 - (d) The vertical line $x = k$ divides the region R into two regions such that when these two regions are revolved about the x -axis, they generate solids with equal volumes. Find the value of k .
-

GO ON TO THE NEXT PAGE 

1998 AP Calculus AB Scoring Guidelines

1. Let R be the region bounded by the x -axis, the graph of $y = \sqrt{x}$, and the line $x = 4$.
 - (a) Find the area of the region R .
 - (b) Find the value of h such that the vertical line $x = h$ divides the region R into two regions of equal area.
 - (c) Find the volume of the solid generated when R is revolved about the x -axis.
 - (d) The vertical line $x = k$ divides the region R into two regions such that when these two regions are revolved about the x -axis, they generate solids with equal volumes. Find the value of k .

(a)



$$A = \int_0^4 \sqrt{x} \, dx = \left. \frac{2}{3} x^{3/2} \right|_0^4 = \frac{16}{3} \text{ or } 5.333$$

$$(b) \int_0^h \sqrt{x} \, dx = \frac{8}{3} \quad \text{or} \quad \int_0^h \sqrt{x} \, dx = \int_h^4 \sqrt{x} \, dx$$

$$\frac{2}{3} h^{3/2} = \frac{8}{3} \quad \text{or} \quad \frac{2}{3} h^{3/2} = \frac{16}{3} - \frac{2}{3} h^{3/2}$$

$$h = \sqrt[3]{16} \text{ or } 2.520 \text{ or } 2.519$$

$$(c) V = \pi \int_0^4 (\sqrt{x})^2 \, dx = \pi \left. \frac{x^2}{2} \right|_0^4 = 8\pi$$

$$\text{or } 25.133 \text{ or } 25.132$$

$$(d) \pi \int_0^k (\sqrt{x})^2 \, dx = 4\pi \quad \text{or} \quad \pi \int_0^k (\sqrt{x})^2 \, dx = \pi \int_k^4 (\sqrt{x})^2 \, dx$$

$$\pi \frac{k^2}{2} = 4\pi \quad \text{or} \quad \pi \frac{k^2}{2} = 8\pi - \pi \frac{k^2}{2}$$

$$k = \sqrt{8} \text{ or } 2.828$$

$$2 \left\{ \begin{array}{l} 1: A = \int_0^4 \sqrt{x} \, dx \\ 1: \text{answer} \end{array} \right.$$

$$2 \left\{ \begin{array}{l} 1: \text{equation in } h \\ 1: \text{answer} \end{array} \right.$$

$$3 \left\{ \begin{array}{l} 1: \text{limits and constant} \\ 1: \text{integrand} \\ 1: \text{answer} \end{array} \right.$$

$$2 \left\{ \begin{array}{l} 1: \text{equation in } k \\ 1: \text{answer} \end{array} \right.$$